ABSTRACT OF PAPERS READ BEFORE SECTION B.

THE MONOCOTYLEDON THE UNIVERSAL TYPE OF SEEDS. — BY THOMAS MEEHAN.

IT must be evident to those who heard my paper on "Adnation in Coniferæ" at the Chicago meeting of the Association that the observation there detailed, could scarcely be accounted for, if the belief be true which is generally held by botanists, that *the leaf originates at the node from which it seems to spring.* It is not, however, an object with me to attack existing theories, or establish new ones; but simply to present facts as I see them. The origin of the leaf will no doubt prove a question which will in time take care of itself. But this generalization cannot be avoided by the readers of that paper, that the whole plant is originally a unity; and that the subsequent formation of elementary organs, and their complete development, or absorption into one another, is the result of varying phases of nutrition. The leaves in Coniferæ were found to be free or united with the stem in proportion to the vigor of the central axis. Following up the subject I now offer some facts which will show that all seeds are primarily Monocotyledonous; and that division is a subsequent act, depending on circumstances which do not exist at the first commencement of the seed growth.

It is well known that in some species of Coniferous plants the number of cotyledons varies. I have noticed in addition to this that whether the cotyledons are few or many, *there is no increase in the whole cotyledonous mass.* In the Norway spruce, *Abies excelsa*, there are sometimes as many as ten cotyledons, in others only two. In the latter case they are broad and ovate, while in the former they are narrow and hair-like; in short, when in the two cotyledoned state it is not possible to note any difference between a seedling Norway spruce and a Chinese arbor vitæ, *Biota orientalis*, except by the lighter shade of green. The two leaved condition is not common, but specimens of threes and others I exhibited to Drs. Torrey and Gray at the Troy meeting. Any one who will examine sprouting seeds of the Norway spruce will agree to the proposition

that the *cotyledons are not original and separate creations*, *but a divided unity.* My next observations were on some acorns of *Quercus agrifolia* the division into cotyledons was numerous and irregular. Cut across vertically some representing the letter C, others the letter N, and again, with four cotyledons the letter M. Here again it was clear that whatever the form and number of the cotyledons *there was no increase of the original cotyledon mass.* Examining sprouting peach kernels, the variations in form and number were of the most remarkable character. I need not repeat them in detail here, as they are reported in the April and May "Proceedings of the Academy of Natural Sciences of Philadelphia." In addition to the fact of no increase in the whole cotyledon mass, it was here clear that *when the cotyledons were duplicated*, *the duplications at least were subsequent to the original ones.* Still so far nothing had been seen to indicate when the first pair of cotyledons were formed. *Quercus macrocarpa* and *Quercus palustris* were silent to my questions. In a large number I found no variations whatever. Each mass was divided smoothly and exactly into two cotyledons. *Quercus robur*, the English oak, however gave some curious evidence. Two germs under one seed coat were numerous and often three, and the cotyledons took on a variety of forms. But there was never any more increase in the cotyledonous mass, than if but two lobes had been formed and there was no more rule in the division than there would be in the sudden breakage of a piece of glass. A detailed account of these will also be found in the "Proceedings of the Academy of Natural Sciences of Philadelphia" for May. *Quercus rubra*, the American red oak, furnished the one link wanting to connect the first division into lobes with the other phenomena. *All* the acorns examined had three or four sutures on the cotyledon mass, and extending all along the longitudinal surface externally, without any reference to cotyledonal divisions. These sutures extended sometimes but a line in depth, at others almost to the centre of the mass, always accompanied by the inner membrane, as is the case in ruminated seeds. The whole mass was divided only in two parts in any that I examined of this species, but the division was always in *the direction of the sutures.* Hence each cotyledon was very irregular. Sometimes one-third the mass only went to one while the other had two-thirds of the whole mass. *It was easier to burst in the weaker line of resistance.* But

the interest for us is to note that originally the cotyledonous mass was a unit — then the sutures or fissures were formed; and ultimately the two divisions of the lobes followed in their direction. *The division was the last condition, not the first.* I know how much we should guard against generalizing on a limited supply of facts, but it requires an effort to believe that oaks, pines, and peaches, as we have seen primordially monocotyledons, are in this respect different from other so called dicotyledonous plants; and if we grant that all seeds are primarily monocotyledonous, may we not ask *why in any case are they divided?* We have seen that there is no increase of mass in the division, the same amount is furnished in one as in many. Would it in any way injure the Indian corn to have its mass divided into two lobes? or would not the plantlet be as well provided for if the acorn were in one solid mass? Division would seem to be a necessity, occurring subsequent to organization, and existing from the position of the plumule alone. In monocotyledons, as we know, the plumule is directed parallel to, or away from the cotyledonous mass, when of course, on this theory it remains an undivided mass. But in the dicotyledonous selection, the plumule is directed towards the apex of the mass and as we know in the case of roots against stone walls, or mushrooms under paving stones, the disposition in the growing force of plants is to go right forward, turning neither to the right nor the left; so in this mass of matter the development of the germ would make easy work of the division; and no doubt often at so early a stage as to give the impression we have been under hitherto, that the division is a primary and essential process.

Prof. GRAY remarked that he was not disposed now, in the absence of Mr. Meehan, and upon the consideration of a paper upon a wholly independent topic, to discuss the author's views upon "Adnation in Coniferæ;" but Mr. Meehan was well aware that they were not quite consistent with the ordinary vegetable morphology. It was more agreeable to be able to say that Mr. Meehan's conclusions, that the apparently polycotyledonous embryo of many Coniferæ is only dicotyledonous, must undoubtedly be regarded as correct. This view was satisfactorily proved by Duchartre, ten or fifteen years ago, and is adopted by Parlatore in the elaboration of Coniferæ for De Candolle's Prodromus, published three or four years ago. But Prof. Gray thought that the appearances in the embryo of oaks, which Mr. Meehan had brought up as evidence that the dicotyledonous embryo was a mere deviation of the monocotyledonous,

and especially that the two cotyledons originated as it were from the splitting up of one, would not be regarded by botanists as in any degree convincing. He presumed that Mr. Meehan perceives that it directly follows from this doctrine that in all opposite leaves the two are organically one, and he would leave to him the undertaking of reconstructing morphology and phyllotaxis upon such a basis.

Dr. T. C. Hilgard remarked, that the whole question came back to the laws of phyllotaxy. The very fact of these "genetic" numbers, as he had called them, required the second element to be derived from the first one; as all radial organs must be derived from their predecessors. The fact itself was apparent in the far too much neglected phenomena of cryptogamous *developments* (or "embryology" of authors). The moss-spore proper (apart from the *Chlorospermeæ* as true moss-*spawns*), develops into a true land (or aquatic) Conferva. The latter bears a bud at the ends of its thread-like "prothallium." Each of its cells is generated out of a preceding one. A terminal cell enlarges into a conical leaf. *Out of that leaf* springs the second, at its base. It is in fact only on the supposition of radial organs generating their successors at the side of the *rift*—at the centre—alternating from either border (as in the case of the pod-leaves, producing fertile ovules), that the whole of phyllotaxic phenomena, and of organic numbers in general, becomes explicable. The production of new elements, however, takes place in a very embryonic condition. Cotyledons already formed do not *divide*. Lobes of fissures, folds, etc., of cotyledons are no divisions, but are due to unequal enlargement. New elements are not formed by division, but by sprouting.

Mechanism of Flexion and Extension in Birds' Wings.—By Dr. Elliott Coues.

Dr. Coues' proposition is, that flexion of the forearm upon the humerus produces flexion (adduction) of the hand upon the forearm, by osseous mechanism alone, and conversely: extension of the forearm causes extension (abduction) of the hand. The point of the article consists in a demonstration of the fact that, in spreading and folding the wing, the radius slides lengthwise along the ulna to a certain extent. Recapitulating certain points in the anatomy of the elbow and wrist, the author shows that this sliding is produced by the relative size, shape and position of the humeral surfaces with which the radius and ulna respectively articulate; these being such, that in flexion of the forearm the radial surface is nearest the wrist-joint, and in extension the ulnar one; and consequently the two bones of the forearm occupy different relative positions in flexion and ex-